#+#########+#################+#########+###@ÿ□#ÿÿd#########d#########1##□##Ôøôú, #Ä#############@ÿ□#ÿÿd#########d#########ö###SUMMARY OF PROGRESS ONSTANDARDS AND RECOMMENDED PRACTICES FORPOWER ELECTRONICS MODULEDr. Sunil M. ChhayaGeneral Motors Advanced Technology VehiclesTroy MIOutlineBackgroundProposed PEM ArchitectureFunctionalityPerformanceConclusions

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#ÿÿ####ÿÿ####@ÿ#ÿÿd#########d#########û### Improved Power Electronics
performance at lower cost is a prime PNGV need Standardization of IPM
Architecture thought to facilitate cost reduction through  up-integration and
spread of application PNGV EE Tech Team is working in collaboration with DoD/DoE
 PNGV power electronics team to produce a user level application spec. for
Integrated Power Module IEEE Power Electronics Module (PEM) Standard Committee
formed to produce  technical requirements and recommended practices for PEMs
interfaces  Four IEEE subgroups working on: Functionality and Performance Power
interface    Control interface  Thermal Interface  IEEE Specification is a
follow-up activity to PNGVs IPM requirements This presentation summarizes
progress on IEEE Spec to-date#
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      }#ÿÿ####ÿÿ####@ÿ□#ÿÿd#########d#########M### Standardization guidelines
for power electronics modules and passives This will achieve interchangeability
and interoperability Specification of interconnection of power circuit
components This will enable modular architectures for scaleable and redundant
systems To achieve cost reduction over time, as a result of the above □
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#######################################@ÿ□#ÿÿd#########d#########3##□##rõlú□í#ÿÿ####ÿÿ####@ÿ□#ÿÿd#########d#########:### Single integrated package, containing  Power conversion stage, DC input / 3 Phase AC Variable Voltage, Variable Frequency (VVVF) output Gate drivers for power switches Monolithic current sensors  Laminated busbar with integrated passives for resonant tank, snubbers and Filtering/EMI Integral liquid-cooled heat-sink Serial communication capability Gate signal generator, with programmable dead-time for hard (PWM)or soft (PPM)       switching Fault detection and status for Current limit Over Temperature Short circuit Out of saturation Functions controlled by on-board microcontroller (mC) or PGA mC or PGA externally programmable  Capable of driving AC Induction and Permanent-Magnet Brushless Motor (Surface or Interior) Fixed mechanical package and mounting provisions that address multiple power levels

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6#ÿÿ####ÿÿ####@ÿ□#ÿÿd#########d#########□### Mass or kW/kg  Volume or kW/Liters
Mounting Provisions Placement and type of terminations Type of fasteners Type of
surface Mounting torque and thread of fasteners Connector Type Number of Pins
Surface Area Current Capability Insertion Force Life Environment Coating Surface
Normal operation, Transit and Accidental Conditions (Shock / Vibrations / Drop)
Natural Frequency #
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ÿ>#ÿÿ####ÿÿ####@ÿ□#ÿÿd#########d#########%### Coolant Properties addressing
Leakage Corrosion Type of fittings (internal / external) Type of passages Air
bubble presence Coolant Specs addressing Type of coolant Coolant inlet
temperature Flow rate Pressure drop Impurity particle size Pressure during
Normal operation Fill-up#
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###########################################@ÿ□#ÿÿd#########d#########1##□##□õ^û¹ #Û#ÿÿ####ÿÿ####@ÿ□#ÿÿd#########d#########u### IEEE specification must be closely coupled to PNGV IPM requirements  IEEE specification should follow PNGV IPM spec in time  Next IEEE workgroup meeting in June 97  PNGV IPM requirements should be (and will be) worked out soon  Potential for industry/government collaboration to initiate PEBB III based on  PNGV/IEEE specifications 5 Step process:  PNGV Spec and identifying overlapping DoD/Navy, DoE requirements IEEE Spec development to continue Request for Information / Proposal from semiconductor manufacturers Begin pre-competitive IPM development Begin IPM production for automotive OEMs for PNGV vehicles#

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Interface Standard#########Functionality and Performance#######"###Dr. Sunil
Chhaya, General Motors
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